

Establishment and Impact of *Terellia virens* on Spotted Knapweed

D. M. Woods, D. B. Joley, and V. Popescu

The most recent addition to the complex of seedhead feeding insects on spotted knapweed in California is the green clearwing fly, *Terellia virens*, (Loew) (Diptera: Tephritidae). We first released *T. virens* in 1996 at the western edge (hill) of our spotted knapweed infestation along the Pit River in Shasta County. In 1997, staff released additional numbers of *T. virens* at this location as well as the 'plot' location some 400 meters east. By July 2000, adults were detected in the field during summer as well as overwintering larva in the end-of-season fall field collections. This report describes the population buildup as well as estimates of seed destruction from 1997 through the summer of 2002.

Population changes of the insect are estimates from our end of season field collections. Ten entire spotted knapweed plants were collected in early fall from each monitoring location. All seedheads were removed, mixed and at least 300 randomly chosen and examined for evidence of insect attack. Seed destruction data were obtained from a separate set of samples, using a methodology designed to collect maturing insects and developing seeds from individual seedheads. To do this, spotted knapweed seedheads with oxidized flowers were enclosed in cotton bags every other week during the flowering season over four years (approximately 50 bagged per site, each week, of each year). At the end of the season, the bagged, mature seedheads were collected, dissected and inspected for viable seed as well as evidence of attack by any seedhead insect.

The tephritid fly, *T. virens* did not establish well at the original two release sites (Table 1). Both sites already had established populations of other biological control insects at that time. In particular, the weevil, *Larinus minutus* had achieved over 70 percent attack rate of the seedheads at these sites. This level of destruction effectively precludes the fly from locating an open niche and escaping being eaten by the weevil larva. Fortunately, adult *T. virens* flies well and spread unaided ahead of the weevil's progression to a site 800 meters upriver (logjam) where it has established a strong population. Although *L. minutus* migrated to the site at nearly the same time, the strong establishment of *T. virens* may actually be limiting development or establishment of *L. minutus*, which currently has only infests 13 percent of the seedheads.

Table 1. Seedhead attack by *Terellia virens* at three sites along the Pit River

	1997	1998	1999	2000	2001	2002
Hill	0.4%	0	0	0.2%	0	0
Plot	4.7%	1.0%	0.4%	0.4%	0.3%	0.2%
Logjam	0	0	4.8%	10.2%	8.5%	21.7%

The larvae of *T. virens* consume seeds as well as other seedhead tissue. Unfortunately, the larvae are usually present singly and seem to consume only about a third of the seed compared to those present in clean seedheads (Table 2). Additionally, the low number of attacked seed severely limits any evaluation. It is possible that when multiple larvae develop within a seedhead, seed loss will be substantial. Until that can be confirmed, *T. virens* should be viewed as a small but significant contributor to biological control of spotted knapweed.

Table 2. Mean Seed Production per Seedhead (Number of Seedheads)

	1998		1999		2000		2001		2002	
	Number Insects	<i>Terellia</i> Only	Number Insects	<i>Terellia</i> Only	Number Insects	<i>Terellia</i> Only	Number Insects	<i>Terellia</i> Only	Number Insects	<i>Terellia</i> Only
Hill	14.9 (46)	10 (1)	11.5 (39)	7 (1)	13.6 (34)	-			10.7 (3)	-
Plot	8.6 (17)		4.3 (14)		12 (6)	8 (1)	11.9 (47)	4 (2)	0 (1)	-
Logjam							16.3 (68)	12 (12)	17.8 (24)	9 (11)